

Observation of Jupiter's Sixth and Seventh Satellites from Photographs taken with the 30-inch Reflector at the Royal Observatory, Greenwich, in 1905-6.—II.

(Communicated by the Astronomer Royal.)

In a preliminary paper in the *Monthly Notices* for 1905 November provisional results were given from the photographs obtained up to November 7. Further photographs of the sixth and seventh satellites have since been secured, and the more accurate method of measurement indicated in the preliminary note has been applied to the whole series.

As there explained, the positions of the satellites have been measured on the photographs taken with the reflector with reference to three or four faint comparison stars (of eleventh or twelfth magnitude) symmetrically distributed round the satellite. The positions of these faint comparison stars were then measured relatively to the reference stars (of eighth to ninth magnitude) in the *Astronomische Gesellschaft Catalogue* (Berlin Zone) from photographs (with 20 minutes' exposure) taken with the astrographic 13-inch refractor, the field sensibly free from distortion being much larger with this telescope than with the reflector, so that from twelve to sixteen reference stars were available on each plate.

As *Jupiter* moved slowly it was possible to make one reference plate serve for a number of photographs, which were each referred to it. The constants were determined in the usual manner, all the stars on the plate given in the *Astronomische Gesellschaft Catalogues* being used for the purpose. Right ascensions and declinations of the satellites were then determined and, by comparison with the tabular positions of *Jupiter*, position angles and distances deduced.

Ten photographs to determine the errors of the tabular place of *Jupiter* were taken between 1905 November 3 and 1906 February 15 with the *Astrographic Equatorial*. Corrections have been deduced from these, but the discussion is not yet complete. They show, however, that the errors of the tabular place of *Jupiter* are very small, and this result is confirmed by the observations with the transit circle and with the altazimuth.

Observations of Satellite VI.

Date and G.M.T.	Apparent R.A.	Apparent Dec.	Pos. Angle.	Dist.	Exp.	No. Plate.
d h m	h m s	° ' "	° ' "	' "	m s	
1905. Aug. 23 13 30	4 10 42.567	+20° 26' 41".62	310° 42' 3"	25' 30".0	30 0	2028
23 14 23	4 10 43.162	+20 26 43.01	310 33.9	25 33.2	31 30	2029
Sept. 3 15 17	4 13 37.103	+20 32 25.60	291 12.1	36 54.4	40 0	2038
7 14 26	4 14 20.651	+20 32 56.45	286 34.2	40 48.4	60 0	2047
7 15 32	4 14 21.184	+20 32 56.78	286 32.0	40 49.8	55 0	2048

Date and G.M.T.				Apparent R.A.			Apparent Dec.			Pos. Angle.		Dist.		Exp.		No. Plate.
1905.	d	h	m	h	m	s							m	s		
Sept.	8	12	56	4	14	29.561	+ 20°	32'	56.02"	285°	34'0"	41'	39.8"	30	0	2050
	12	14	37	4	15	1.576	+ 20	32	28.46	281	37.5	45	12.1	20	0	2054
	12	15	5	4	15	1.639	+ 20	32	29.34	281	37.5	45	14.0	20	0	2055
	12	15	42	4	15	1.783	+ 20	32	28.23	281	35.2	45	15.6	30	0	2056
	30	12	17	4	15	14.100	+ 20	21	54.75	267	49.0	54	49.3	60	0	2068
Oct.	4	12	25	4	14	47.959	+ 20	17	52.93	265	0.7	55	25.7	40	0	2070
	4	14	55	4	14	47.132	+ 20	17	45.73	264	55.8	55	26.3	34	0	2071
	4	16	38	4	14	46.515	+ 20	17	40.98	264	52.7	55	27.4	39	0	2072
	5	11	52	4	14	39.912	+ 20	16	48.24	264	18.7	55	30.6	30	0	2074
	5	14	7	4	14	39.143	+ 20	16	42.09	264	14.8	55	30.5	59	14	2075
	21	10	55	4	11	5.799	+ 19	55	34.19	251	59.5	51	52.5	45	0	2079
	21	11	54	4	11	5.047	+ 19	55	30.30	251	57.4	51	51.8	45	0	2080
	22	10	46	4	10	47.518	+ 19	54	2.67	251	6.4	51	23.2	40	0	2081
	22	12	4	4	10	46.602	+ 19	53	57.18	251	2.4	51	20.2	75	0	2082
	25	10	47	4	9	49.341	+ 19	49	17.99	248	14.7	49	43.1	30	0	2086
	25	11	47 (a)	4	9	48.488	+ 19	49	15.10	248	13.3	49	41.2	60	0	2087
	27	10	17	4	9	8.437	+ 19	46	5.39	246	14.0	48	30.5	40	0	2089
	27	10	58	4	9	7.783	+ 19	46	3.27	246	12.2	48	29.5	28	51	
	29	9	47	4	8	25.544	+ 19	42	49.58	244	7.0	47	13.8	30	0	2091
	29	10	20	4	8	25.051	+ 19	42	47.72	244	5.4	47	11.8	25	0	2092
	29	12	19*	4	8	23.396	+ 19	42	40.21	(243 59.9)	(47 6.6)	177	12			2093
	29	14	17	4	8	21.417	+ 19	42	31.64	243	55.4	47	5.8	17	0	2094
	31	10	24	4	7	39.848	+ 19	39	25.40	241	48.4	45	51.4	25	3	2096
	31	10	49	4	7	39.427	+ 19	39	23.84	241	47.9	45	51.2	20	0	
	31	12	3	4	7	38.347	+ 19	39	19.98	241	44.6	45	46.9	84	5	2097
Nov.	3	9	52	4	6	29.708	+ 19	34	22.57	238	5.4	43	42.9	30	0	2098
	3	11	48	4	6	27.898	+ 19	34	12.33	237	57.8	43	37.7	54	17	2100
	6	10	19	4	5	15.319	+ 19	29	7.67	233	53.3	41	27.0	15	0	2104
	6	10	48	4	5	14.776	+ 19	29	5.29	233	51.7	41	26.7	15	0	2105
	6	11	50	4	5	13.828	+ 19	29	0.56	233	46.0	41	23.4	70	0	2106
	7	14	12	4	4	45.963	+ 19	27	5.83	232	7.0	40	33.8	15	0	2110
	7	15	14	4	4	44.840	+ 19	27	1.23	232	3.1	40	32.2	90	0	2111
	21	9	9	3	58	35.044	+ 19	3	4.29	203	32.5	31	34.7	15	0	2118
	21	9	27	3	58	34.684	+ 19	3	3.42	203	31.1	31	34.0	15	0	
	23	12	26	3	57	35.788	+ 18	59	28.13	197	46.7	30	45.6	90	0	2121

* Owing to the long exposure (nearly 3 hours) the star trails are so long that the results of the measures are liable to considerable uncertainty.

(a) Very poor image.

1905.	Date and G.M.T.			Apparent R.A.			Apparent Dec.		Pos. Angle.	Dist.	Exp.		No. Plate.
	d	h	m	h	m	s	°	'			m	s	
Nov.	23	13	33	3	57	34.454	+18	59' 23.84"	197° 39' 8"	30' 44.6"	15	0	2122
	23	13	53	3	57	34.064	+18	59' 22.12"	197° 37' 6"	30' 44.3"	20	0	
	24	10	31	3	57	10.277	+18	57' 55.76"	195° 11' 9"	30' 29.2"	60	0	2126
	24	11	19	3	57	9.358	+18	57' 52.72"	195° 6' 2"	30' 28.3"	10	0	2127
	24	11	33	3	57	9.059	+18	57' 51.70"	195° 4' 3"	30' 28.1"	15	0	
	27	6	52 (b)	3	55	51.612	+18	53' 16.58"	187° 1' 1"	29' 55.8"	5	0	2129
	27	7	1 (b)	3	55	51.502	+18	53' 16.14"	186° 58.4"	29' 55.5"	10	0	
	29	9	38	3	54	53.828	+18	49' 54.97"	180° 47.2"	29' 50.0"	20	0	2131
	29	9	55	3	54	53.525	+18	49' 53.57"	180° 44.6"	29' 50.2"	10	0	
	29	10	33	3	54	52.844	+18	49' 51.23"	180° 39.1"	29' 50.1"	30	0	2132
Dec.	29	11	17	3	54	52.062	+18	49' 48.63"	180° 32.4"	29' 49.9"	19	0	2133
	19	6	56	3	46	49.665	+18	24' 32.09"	134° 28.0"	39' 34.1"	60	0	2141
	19	7	50	3	46	48.978	+18	24' 30.27"	134° 23.2"	39' 36.4"	30	0	2142
	19	8	21 (a)	3	46	48.517	+18	24' 29.85"	134° 20.6"	39' 36.7"	7	30	2143
	19	8	34	3	46	48.372	+18	24' 28.88"	134° 19.9"	39' 37.7"	15	0	
	25	7	44	3	44	56.674	+18	19' 47.59"	126° 15.5"	44' 6.9"	18	30	2147
	25	8	41	3	44	56.088	+18	19' 45.69"	126° 12.1"	44' 9.7"	30	0	2149
	25	9	34	3	44	55.469	+18	19' 44.42"	126° 9.3"	44' 11.4"	60	0	2150
	25	10	21	3	44	54.884	+18	19' 43.86"	126° 6.5"	44' 12.1"	5	0	2151
	25	10	32	3	44	54.755	+18	19' 43.14"	126° 6.5"	44' 12.6"	15	0	
1906. Jan.	30	7	42	3	43	39.272	+18	17' 8.12"	120° 52.5"	47' 43.2"	60	0	2153
	30	8	42	3	43	38.726	+18	17' 6.89"	120° 50.0"	47' 45.3"	25	45	2154
	13	9	35	3	41	30.854	+18	16' 26.58"	109° 54.9"	55' 46.8"	30	0	2169
	13	10	11	3	41	30.715	+18	16' 27.24"	109° 53.9"	55' 46.9"	10	0	2170
	13	10	28	3	41	30.705	+18	16' 27.45"	109° 53.4"	55' 47.7"	10	0	2171
	15	12	11	3	41	23.599	+18	17' 12.43"	108° 38.3"	56' 38.1"	14	39	2174
	19	10	11 (a)	3	41	18.661	+18	19' 14.80"	106° 24.4"	57' 57.6"	90	0	2175
	19	11	15	3	41	18.739	+18	19' 16.83"	106° 22.3"	57' 59.1"	9	0	2176
	19	11	25 (a)	3	41	18.751	+18	19' 17.35"	106° 21.9"	57' 59.3"	8	0	
	22	9	4	3	41	22.465	+18	21' 17.91"	104° 50.0"	58' 45.0"	90	0	2180
	22	10	8	3	41	22.597	+18	21' 21.21"	104° 47.3"	58' 45.6"	10	0	2181
	22	10	19	3	41	22.604	+18	21' 21.16"	104° 47.5"	58' 45.6"	10	0	
	23	8	45	3	41	25.117	+18	22' 5.99"	104° 18.6"	58' 57.3"	60	0	2183
	23	9	47	3	41	25.307	+18	22' 7.95"	104° 17.2"	58' 58.7"	35	46	2184
	24	8	12 (c)	3	41	28.508	+18	22' 55.00"	103° 49.2"	59' 9.3"	60	0	2185
	26	10	12	3	41	37.892	+18	24' 49.66"	102° 47.7"	59' 28.3"	40	0	2186
	30	7	46	3	42	4.286	+18	28' 58.90"	100° 55.1"	59' 52.1"	30	0	2189

(a) Very poor image.

(b) Very faint and diffused.

(c) Faint.

May 1906. *Jupiter's Sixth and Seventh Satellites.*

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Date and G.M.T.				Apparent R.A.			Apparent Dec.	Pos. Angle.	Dist.	Exp.	No. Plate.	
1906.	d	h	m	h	m	s				m	s	
Jan.	30	8	30 (<i>d</i>)	3	42	4'388	+18°28'59"73	100°55'9	59'50"3	42	49	2190
	30	9	31	3	42	4'767	+18 29 3'69	100 53'6	59 50'9	10	44	} 2191
	30	9	45 (<i>e</i>)	3	42	4'847	+18 29 3'16	100 54'5	59 51'7	7	48	
Feb.	12	6	49 (<i>b</i>)	3	44	44'628	+18 47 25'81	95 23'0	57 51'6	35	0	2206
	12	7	30 (<i>c</i>)	3	44	45'067	+18 47 28'80	95 22'2	57 50'5	35	0	2207
	12	8	6	3	44	45'447	+18 47 31'53	95 21'4	57 49'5	15	0	} 2208
	12	8	18 (<i>f</i>)	3	44	45'581	+18 47 31'75	95 21'8	57 49'3	7	0	
	14	7	49	3	45	20'593	+18 50 59'30	94 28'0	57 18'9	25	40	2213
	15	8	24	3	45	39'672	+18 52 48'90	94 1'2	57 1'1	35	0	2217
(<i>b</i>) Very faint and diffused.							(<i>e</i>) Faint.	(<i>d</i>) Very diffused.				
(<i>e</i>) Very faint.							(<i>f</i>) Diffused.					

(b) Very faint and diffused.

(c) Faint.

(d) Very diffused.

(e) Very faint.

(f) Diffused.

Observations of Satellite VII.

Date and G.M.T.				Apparent R.A.			Apparent Dec.	Pos. Angle.	Dist.	Exp.	No. Plate.					
1905.	d	h	m	h	m	s	°	'	"	m	s					
Oct.	22	12	4 (a)	4	11	21·917	+ 20	22	37·71	286°	35·5	41	52·3	75	0	2082
	29	12	19 (b)	4	9	14·364	20	12	25·29	286	39·5	31	34·7	177	12	2093
	29	14	17	4	9	12·664	20	12	16·70	286	37·5	31	27·8	17	0	2094
	31	12	3	4	8	33·873	20	9	13·19	286	43·8	28	22·1	84	5	2097
Nov.	3	11	48 (c)	4	7	29·995	20	4	11·40	286	57·6	23	18·0	54	17	2100
	6	11	50 (c)	4	6	22·872	19	58	53·38	287	29·0	17	53·1	70	0	2106
	7	15	14	4	5	55·910	19	56	49·95	287	42·7	15	55·2	90	0	2111
	23	12	26 (d)	3	59	14·996	19	26	2·13	100	58·6	14	17·0	90	0	2121
	24	10	31	3	58	50·433	19	24	13·13	101	17·1	15	57·3	60	0	2126
	29	10	33	3	56	37·172	19	14	21·63	102	18·1	24	51·4	30	0	2132
Dec.	19	6	56 (c)	3	48	11·497	18	40	40·88	103	35·3	48	56·8	60	0	2141
	25	8	41	3	45	56·035	18	33	19·26	104	3·1	51	20·2	30	0	2149
	25	9	34	3	45	55·293	18	33	18·07	104	2·0	51	20·9	60	0	2150
	30	7	42 (e)	3	44	16·984	18	28	44·11	104	27·1	51	29·2	60	0	2153
	30	8	42	3	44	16·128	18	28	42·34	104	27·4	51	27·7	25	45	2154
1906.																
Jan.	19	10	11 (e)	3	40	0·128	18	24	18·82	107	8·0	38	39·6	90	0	2175
	23	8	45 (f)	3	39	42·537	18	26	9·57	107	57·1	34	27·1	60	0	2183
	23	9	47 (g)	3	39	42·536	18	26	10·59	107	57·4	34	26·1	36	46	2184
	26	10	12	3	39	37·292	18	28	9·57	108	43·7	31	1·3	40	0	2186

(a) Very diffused.

(b) Very diffused. Star trails 66" long, and consequently subject to uncertainty in measurement of their positions.

(c) Very faint.

(d) Faint and diffused.

(e) Very poor photograph.

(f) Extremely faint.

(g) Faint.

Royal Observatory, Greenwich:
1906 May 11.

Observations of Uranus at Windsor, New South Wales. By John Tebbutt.

The following are the results of comparisons of *Uranus* made with *I Sagittarii* by means of the filar micrometer on the 8-inch equatorial. The estimated centre of the planet's disc was chosen for observation. The last two columns contain a comparison of the results with the transit ephemeris on page 280 of the *Nautical Almanac*.

1905.	Windsor Mean Time.	Planet-Star		No. of Comps.	Reduction to Apparent Place.		Parallax Corrections.		Concluded Geocentric Apparent Place of Planet.			Obs.-Cal.	
		$\Delta\alpha$.	$\Delta\delta$.		α .	δ .	α .	δ .	h	m	s	α .	δ .
July 15	8 47 29	+14.34	+47.2	10	+2.81	+8.9	-0.01	-0.1	18 6	12.61		+0.11	-2.0
" 16	8 45 45	+ 4.56	+45.2	6	+2.81	+8.9	-0.01	-0.1	18 6	2.83		-0.02	-2.3
" 17	8 13 37	- 4.72	+44.4	20	+2.81	+8.9	-0.02	-0.1	18 5	53.54		+0.05	-1.5
" 21	7 41 38	-41.78	+38.3	20	+2.81	+8.8	-0.02	-0.1	18 5	16.48		+0.07	-2.0
" 22	7 40 34	-50.86	+37.3	20	+2.81	+8.8	-0.02	-0.1	18 5	7.40		+0.04	-1.7
" 23	7 40 57	-59.90	+36.2	20	+2.81	+8.8	-0.02	-0.1	18 4	58.36		-0.05	-1.5

The mean place of the comparison star for 1905.0 is $\alpha = 18^h 5^m 55^s.47$, $\delta = 23^\circ 43' 16''.1$. It is derived from the following authorities: Argentine Gen. Cat. 1875, No. 24755; Greenwich Ten-year Cat. 1880, No. 2884; Stone, 1880, No. 9907; Greenwich 2nd Ten-year Cat. 1890, No. 4509; and Radcliffe Cat. 1890, No. 4748.

Observatory, Peninsula, Windsor, N.S. Wales:
1906 March 8.